Realizing Sustainability in Center Strategic Planning

NASA RAP & P2 Workshop 2005

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Overview

- Framing the Issues - Sustainability
- Reminders – Things You Already Know
- “Viral” Sustainability
- Three Disciplines

Framing Issues – Where We Are

34 Years Later . . .

56 Years Later . . .

By and large, our present problem is one of attitudes and implements.

We are remodeling the Alhambra with a steam-shovel, and we are proud of our yardage.

We shall hardly relinquish the shovel, which after all has many good points, but we are in need of gentler and more objective criteria for its successful use.

Aldo Leopold - A Sand County Almanac

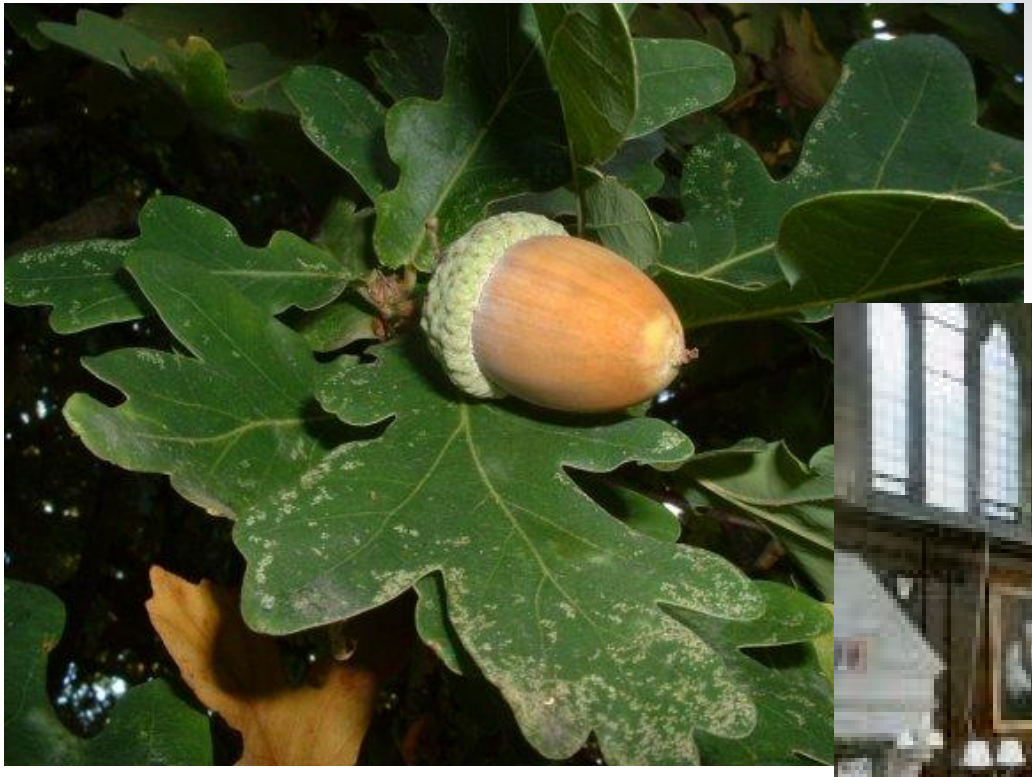
Why Focus on Sustainability?

Growing demand* is on a collision-course with *declining resources

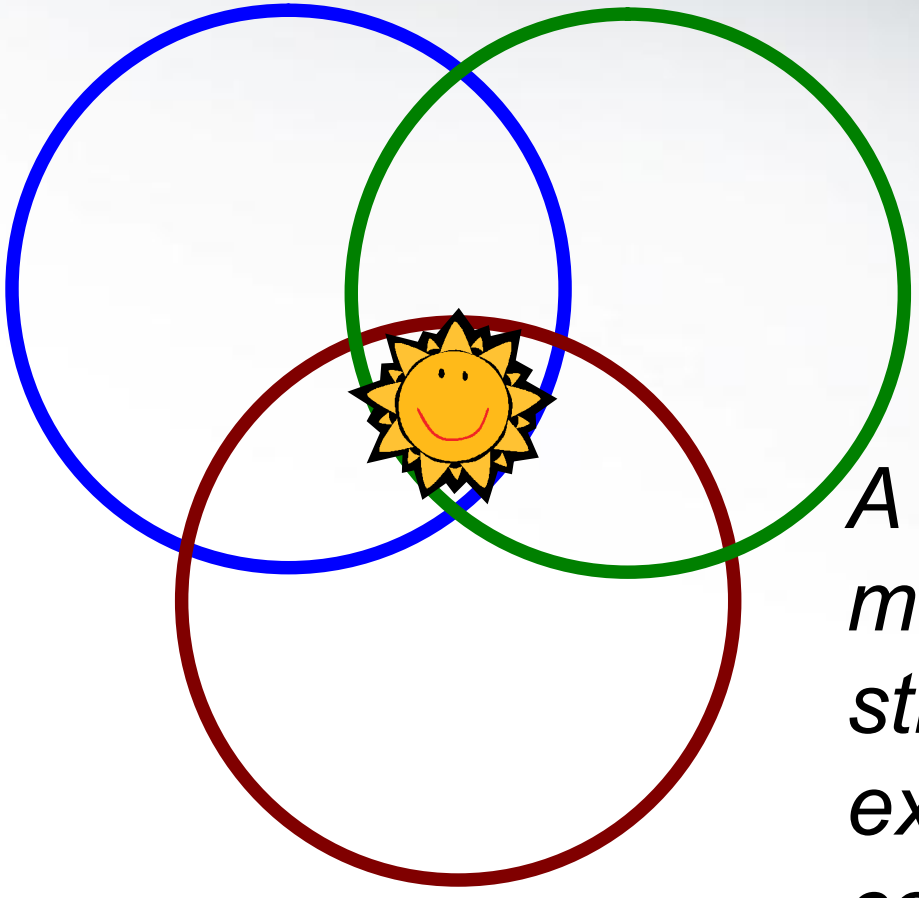
- Current consumption and pollution trends *will* leave future generations with more problems and fewer solutions options.
- All human and natural activity must occur within (or launch from) the finite physical constraints of the planet Earth.
- The pace of degradation and the magnitude of the problem are increasing, in spite of impressive successes.
- **"The same technology that helps humans extend our presence into space may help solve . . . key environmental sustainability issues." (Ewert, JSC's Role in a Sustainable Future)**

What is Sustainability?

- [Sustainable development] meets the needs of the present without compromising the ability of future generations to meet their own needs
- The NASA mission is “To understand and protect our home planet, to explore the universe and search for life, to inspire the next generation of explorers …as only NASA can.”
- *Sustainability means living and working as if you really believe in a tomorrow*



Sustainable Development



A multi-attribute maximization strategy – many examples to come!

A Few Reminders

- "Resource" is a topic that embodies both economic *and* physical attributes
- We are NOT going to run out of any particular physical resource - *Did a shortage of stones end the stone age?*
- We ARE going to run out of willingness to pay (in $, frustration, and consequences) for some resources and in some locations
- So, at $10 billion dollars or 1 million cases of cancer or 1 million refugees per pound or per barrel or per bushel, we have an infinite supply . . . *What are you willing to pay?*

Why Sustainability?

- **Image** – Creation, enhancement
- **Ethics** – Organizational & individual responsibility
- **Advantage** - Competitive advantage, prevent disadvantage
- **Risk** - Economic, regulatory, perception
- **Money** - Cost savings, opportunity costs for capital investments

Sustainability is NOT . . .

- Luxury
- Religion (or anti-religion)
- Formulaic
- Fragile
- Final
- Free

A Sustainable Center?

More than just Environmental Management (of course, EM is vital)

- Obtaining adequate resources reliably, without regrets
- Continuous and strengthened support for missions
- No impediments to mission planning, execution, completion
- Neighbors, not tenants
- Leadership – “Sustaining the long-term exploration of the solar system requires a robust space industry that will contribute to national economic growth, produce new products through the creation of new knowledge, and lead the world in invention and innovation. This space industry will become a national treasure.”

Potential Center Benefits

- Happier, healthier, more productive people, lower wage and cost pressure
- Less vulnerability to unpredictable developments
- Less complex and costly operations planning, more resources deployable to primary missions
- More reliable logistical support, fewer constraints
- More supportive local population; community as resource

Some Reminders – Things You Forgot You Knew

Nature Doesn't Compromise

Nature Optimizes:

The Pelican is not a compromise between a seagull and an otter . . . It is simply the best Pelican that Nature could so far devise.

Multi-Attribute Maximization

NOT “balancing economy and environment”

	Economy	Environment	Society
Wind power	✓	✓	✓
Biobased materials	✓	✓	✓
Distributed water	✓	✓	✓
The Woodlands, TX Davis, CA	✓	✓	✓
Green buildings	✓	✓	✓

The Logic of Natural Capitalism

- Dramatically improve efficiency
- Close the loops, biomimicry
- Align interests
- Reinvest in and restore natural capital

www.natcap.org

The Logic of Natural Step

In a sustainable society, nature is not subject to systematically increasing:

- concentrations of substances extracted from the earth's crust;
- concentrations of substances produced by society;
- degradation by physical means

and, in that society. . .

- human needs are met worldwide.

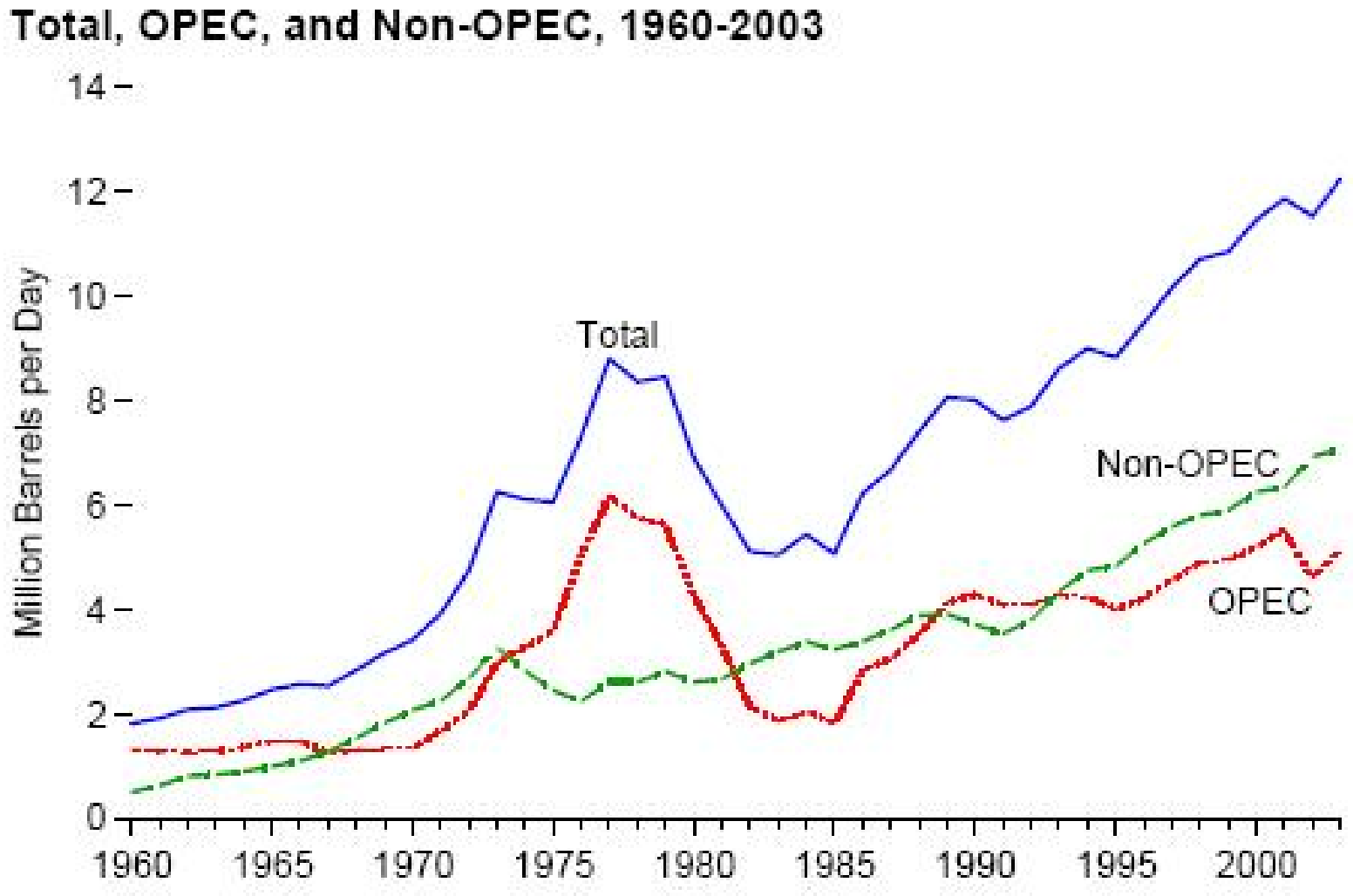
www.naturalstep.org

Commoner's Four Rules

. . . of Ecology

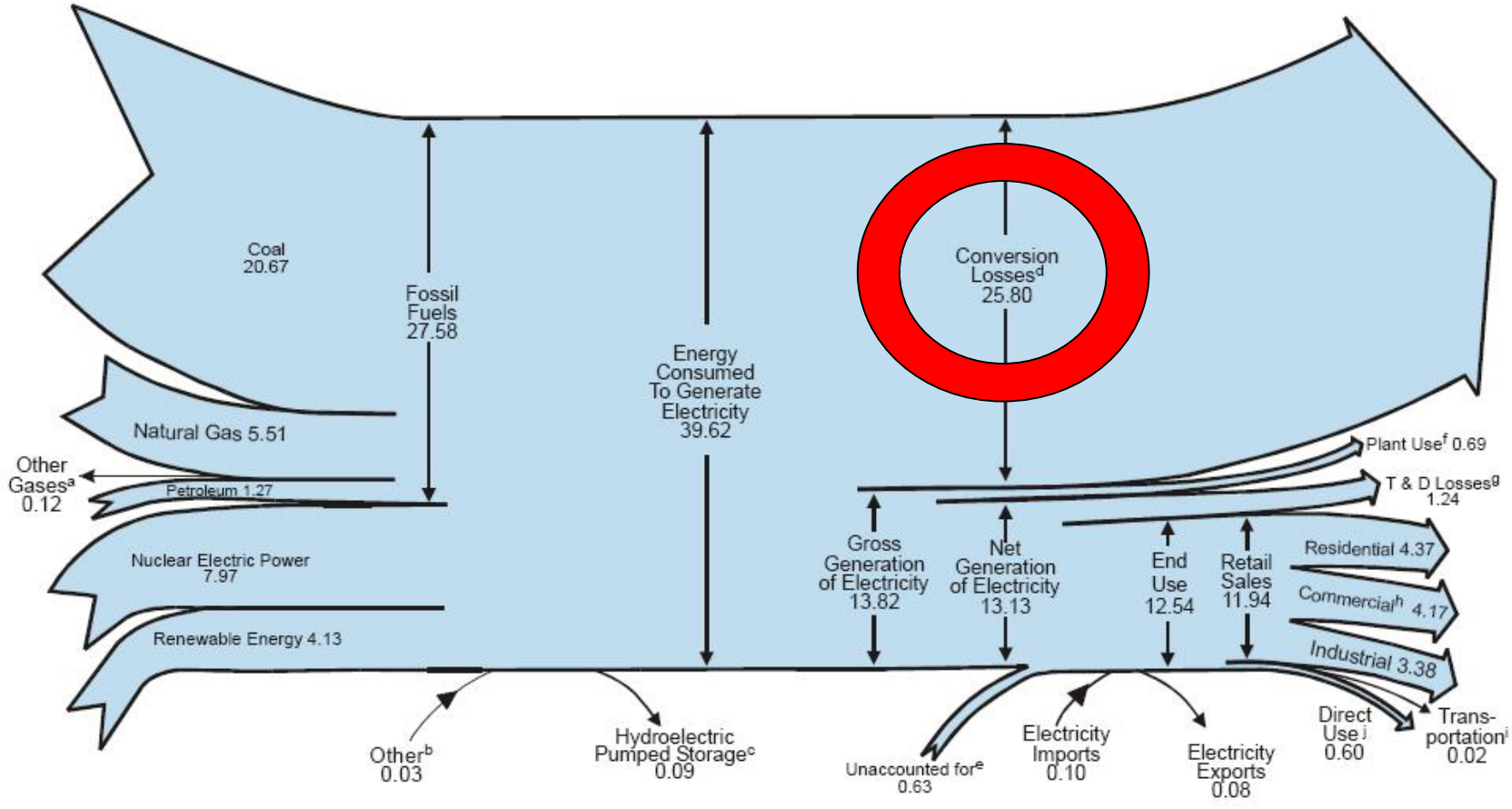
1. Everything is Connected to Everything Else
2. Everything Has to Go Somewhere
3. Nature Knows Best
4. There is No Such Thing as a Free Lunch

No Free Lunch



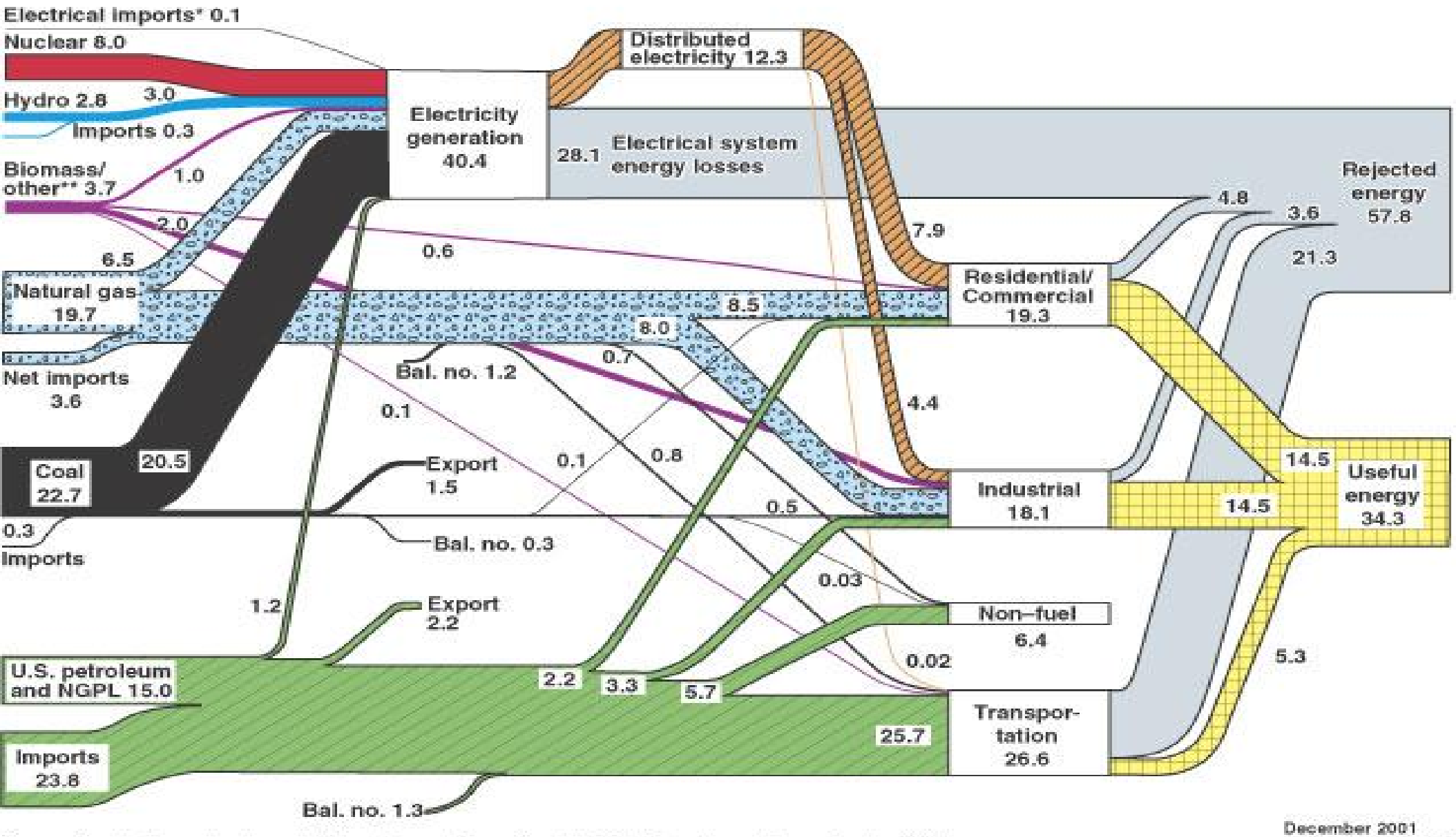
Everything Has to Go Somewhere

Diagram 5. Electricity Flow, 2003
(Quadrillion Btu)



[a] Blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.
[b] Batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.
[c] Pumped storage facility production minus energy used for pumping.
[d] Approximately two-thirds of all energy used to generate electricity. See note "Electrical System Energy Losses," at end of Section 2.
[e] Data collection frame differences and nonsampling error.
[f] Electric energy used in the operation of power plants, estimated as 5 percent of gross generation. See note "Electrical System Energy Losses," at end of Section 2.
[g] Transmission and distribution losses (electricity losses that occur between the point of generation and delivery to the customer) are estimated as 9 percent of gross generation. See note "Electrical System Energy Losses," at end of Section 2.
[h] Commercial retail sales plus approximately 95 percent of "Other" retail sales from Table 8.9.
[i] Approximately 5 percent of "Other" retail sales from Table 8.9.
[j] Commercial and industrial facility use of onsite net electricity generation; and electricity sales among adjacent or co-located facilities for which revenue information is not available.
Note: Totals may not equal sum of components due to independent rounding.
Sources: Tables 2.1b-2.1e, 8.1, 8.4a, and A6 (column 4).

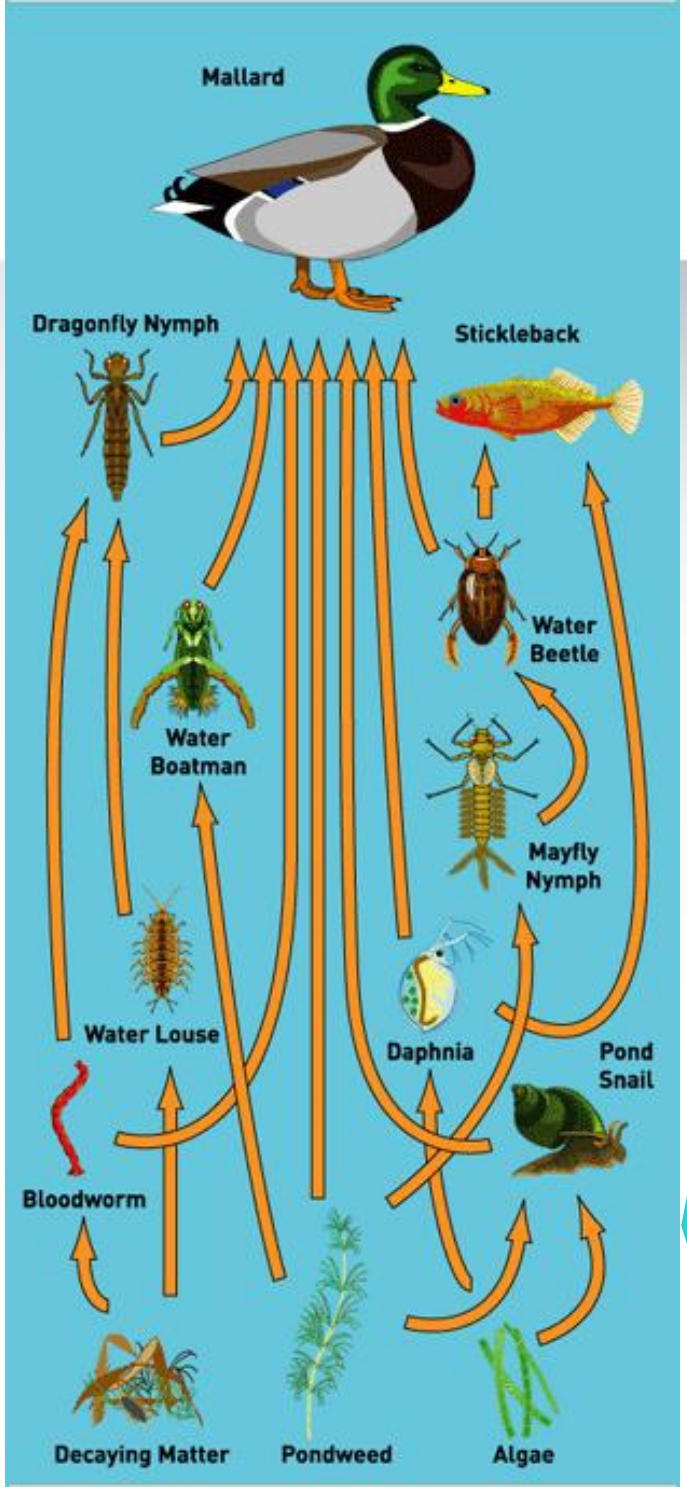
U.S. Energy Flow Trends – 2000
Net Primary Resource Consumption 98.5 Quads



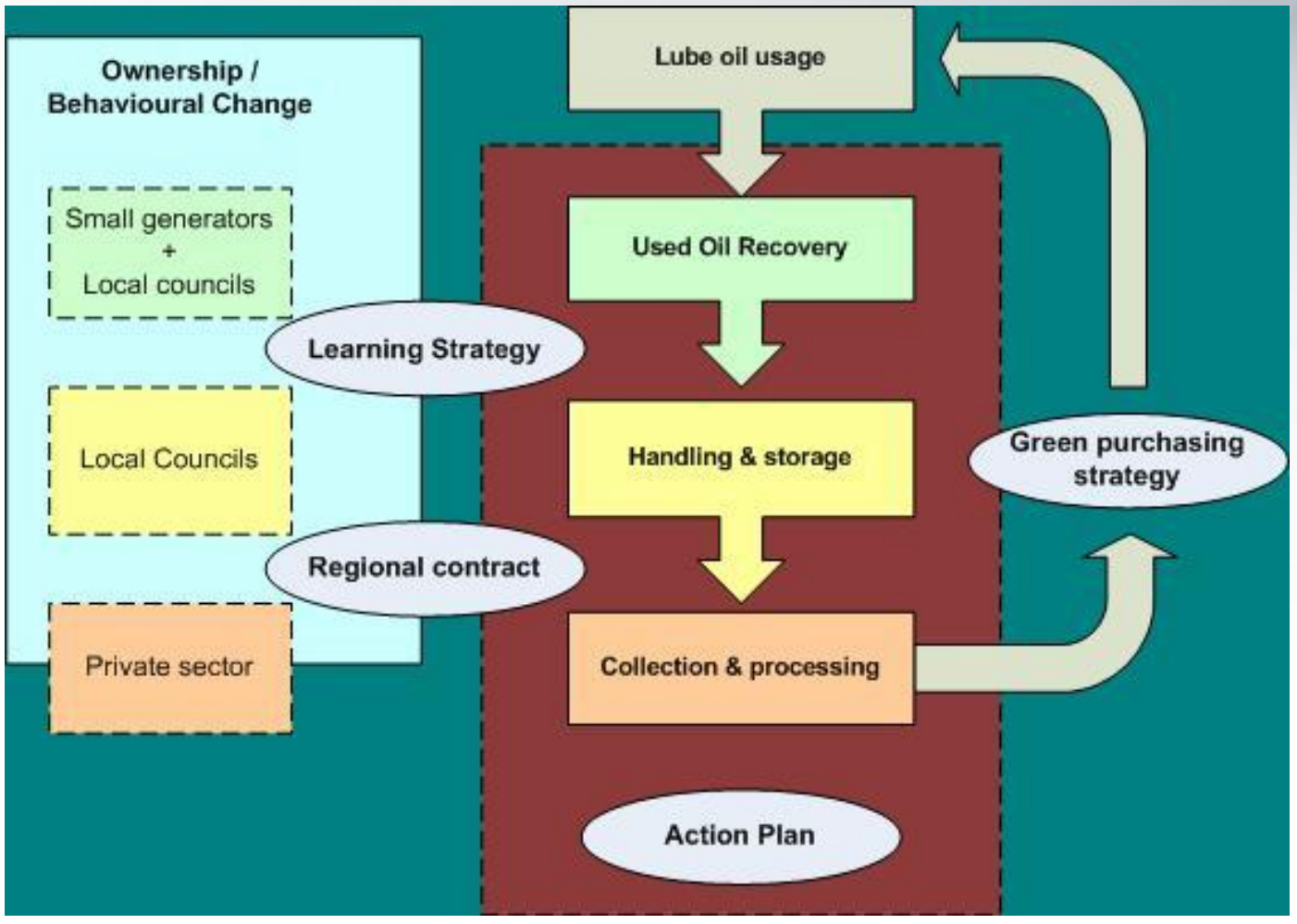
Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2000*
*Net fossil-fuel electrical imports
**Biomass/other includes wood and waste, geothermal, solar, and wind.

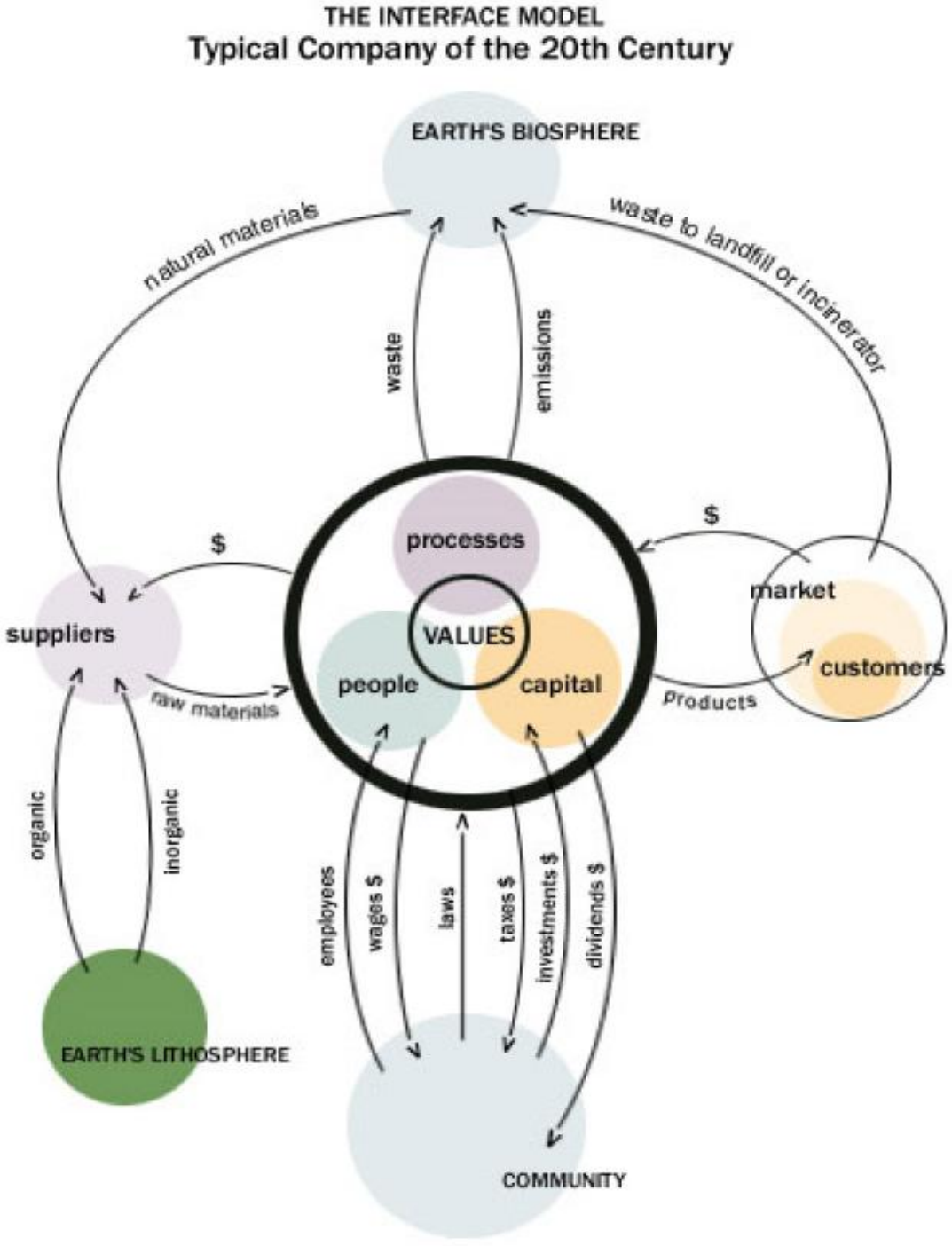
December 2001
Lawrence Livermore
National Laboratory

Webs of Life

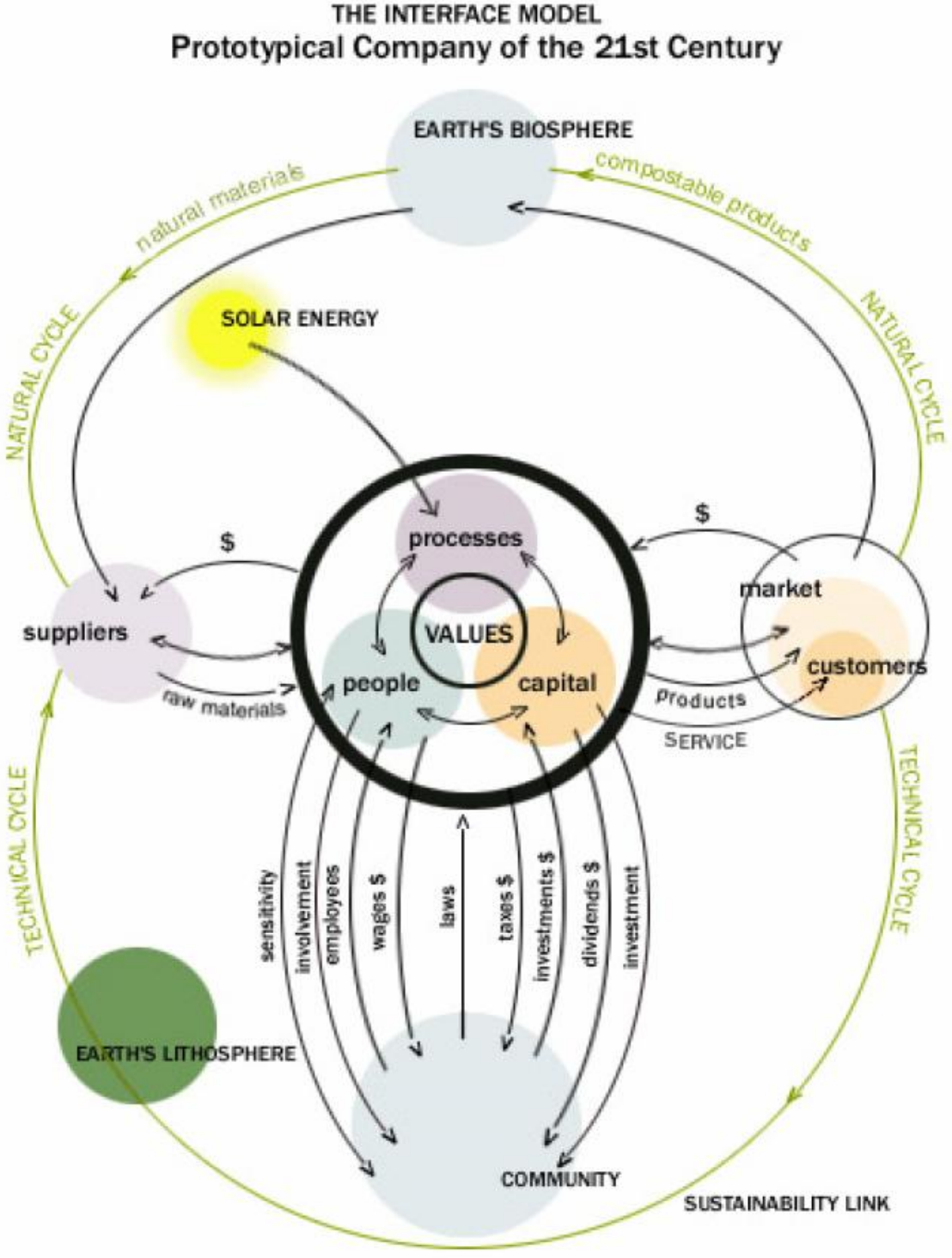

Mallard
Dragonfly Nymph
Stickleback
Water Beetle
Water Boatman
Mayfly Nymph
Water Louse
Daphnia
Pond Snail
Bloodworm
Decaying Matter
Pondweed
Algae

Closing the Loop

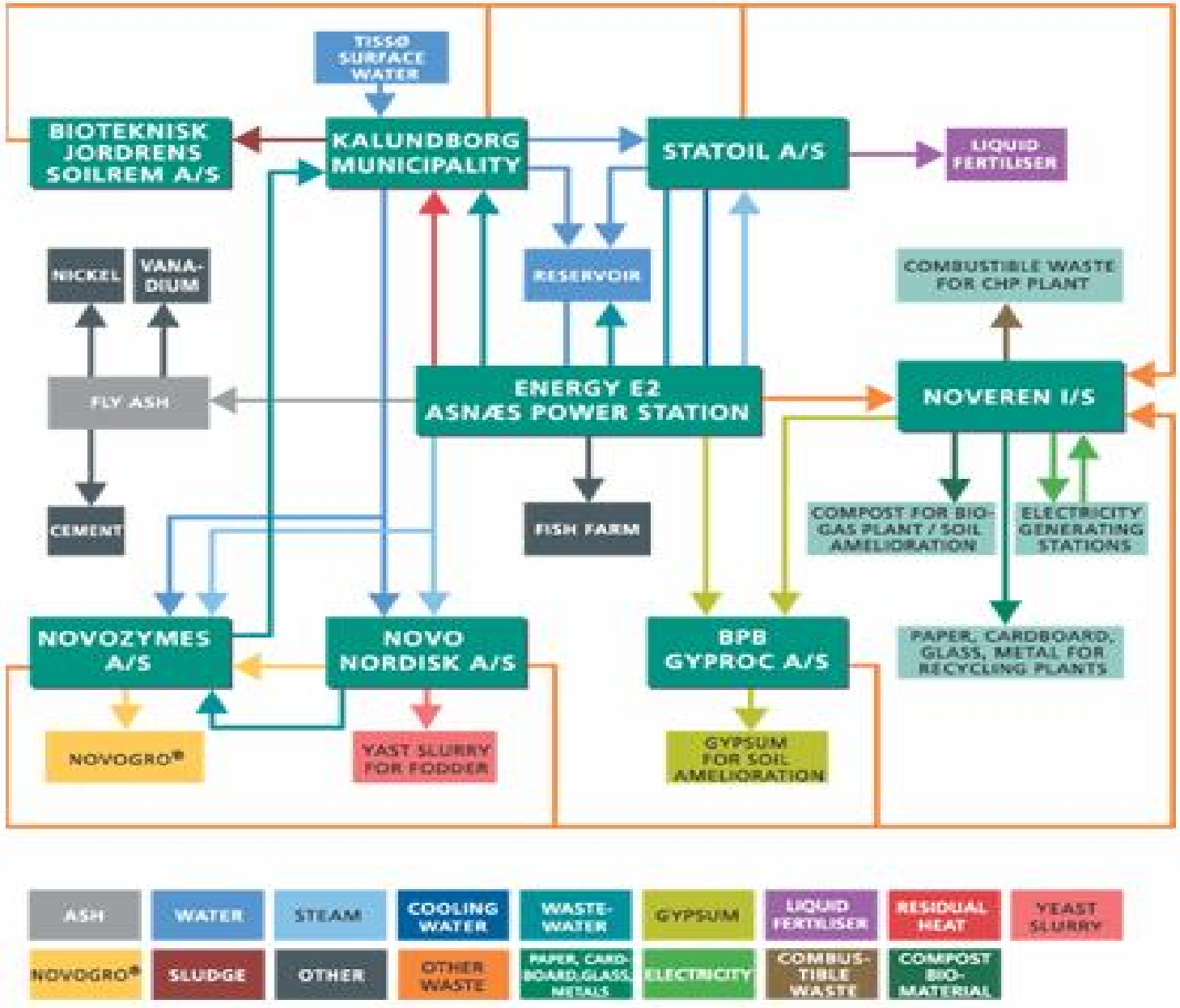




Works for enterprises, too.


THE INTERFACE MODEL
Prototypical Company of the 21st Century
EARTH'S BIOSPHERE
natural materials
compostable products
NATURAL CYCLE
NATURAL CYCLE
SOLAR ENERGY
$
$
processes
suppliers
market
VALUES
people
capital
customers
raw materials
Products
SERVICE
TECHNICAL CYCLE
TECHNICAL CYCLE
sensitivity
involvement
employees
wages $
laws
taxes $
investments $
dividends $
investment
EARTH'S LITHOSPHERE
COMMUNITY
SUSTAINABILITY LINK

Better Communities



Some of the Benefits

- **Total water consumption –**Reduced the overall consumption by 25% by recycling the water and by letting it circulate between the partners. Savings/year: 1.9 million cubic metres ground water, 1 million cubic metres surface.
- **Oil -** Reduced oil consumption by 20,000 tonnes per year, corresponding to a 380-tonne reduction of sulphur dioxide/year. The major reductions have been achieved by Novozymes A/S, Novo Nordisk A/S and Statoil that have used process steam from the production at Asnæs Power Station.
- **Ash -** The combustion of coal and orimulsion at Asnæs Power Station results in approx. 80,000 tonnes of ash, which are used in the construction and cement industries for the manufacturing of cement or the extraction of nickel and vanadium.
- **Gypsum -** Every year BPB Gyproc A/S receives up to 200,000 tonnes of gypsum from Asnæs Power Station. This figure corresponds to the large majority of the companyís annual consumption. The gypsum substitutes the natural gypsum used in the production of plasterboards.
- **NovoGro® -** NovoGro® from Novozymes A/S substitutes the use of lime and part of the commercial fertiliser on approximately 20,000 hectares of farmland.
- **Wastewater -** The collaboration of Novozymes A/S, Asnæs Power Station and Kalundborg Municipality, in the area of wastewater treatment, reduces the environmental impact on Jammerland Bugt considerably.
- **Sludge -** The recycling of sludge stemming from the treatment plant brings about a reduction in production time at A/S Bio-teknisk Jordrens Soilrem, synonymous with expenditure cuts and improved economy.

But Wait! There's More

- **Other Waste (per year):**
  - 13,000 tonnes of newspaper / cardboard which after a quality check are sold to cardboard and paper consuming industries in Denmark, Sweden and Germany producing new paper, new cardboard, egg boxes and trays for e.g. the health sector.
  - 7,000 tonnes of rubble and concrete that are used for different surfaces after crushing and sorting.
  - 15,000 tonnes of garden / park refuse delivered as soil amelioration in the area.
  - 4,000 tonnes of bio waste from households and company canteens. The bio waste is used in the compost and biogas production.
  - 4,000 tonnes of iron and metal, which is resold after cleaning for recycling.
  - 1,800 tonnes of glass and bottles that are sold to producers of new glass.
- **Advantages of the Symbiosis**
  - Recycling of by-products. The by-product of one company becomes an important resource for another company.
  - Reduced consumption of resources, e.g. water, coal, oil, gypsum, fertiliser, etc.
  - Reduced environmental strain: reduced CO2 and SO2 emissions, reduced discharges of wastewater and less pollution of watercourses etc.
  - Improved utilisation of the energy resources. Waste gases are used in the energy production.

Building Lasting Solutions – Getting Where We Want to Be

Mapping Sustainability Objectives to Mission

“Viral” Sustainability

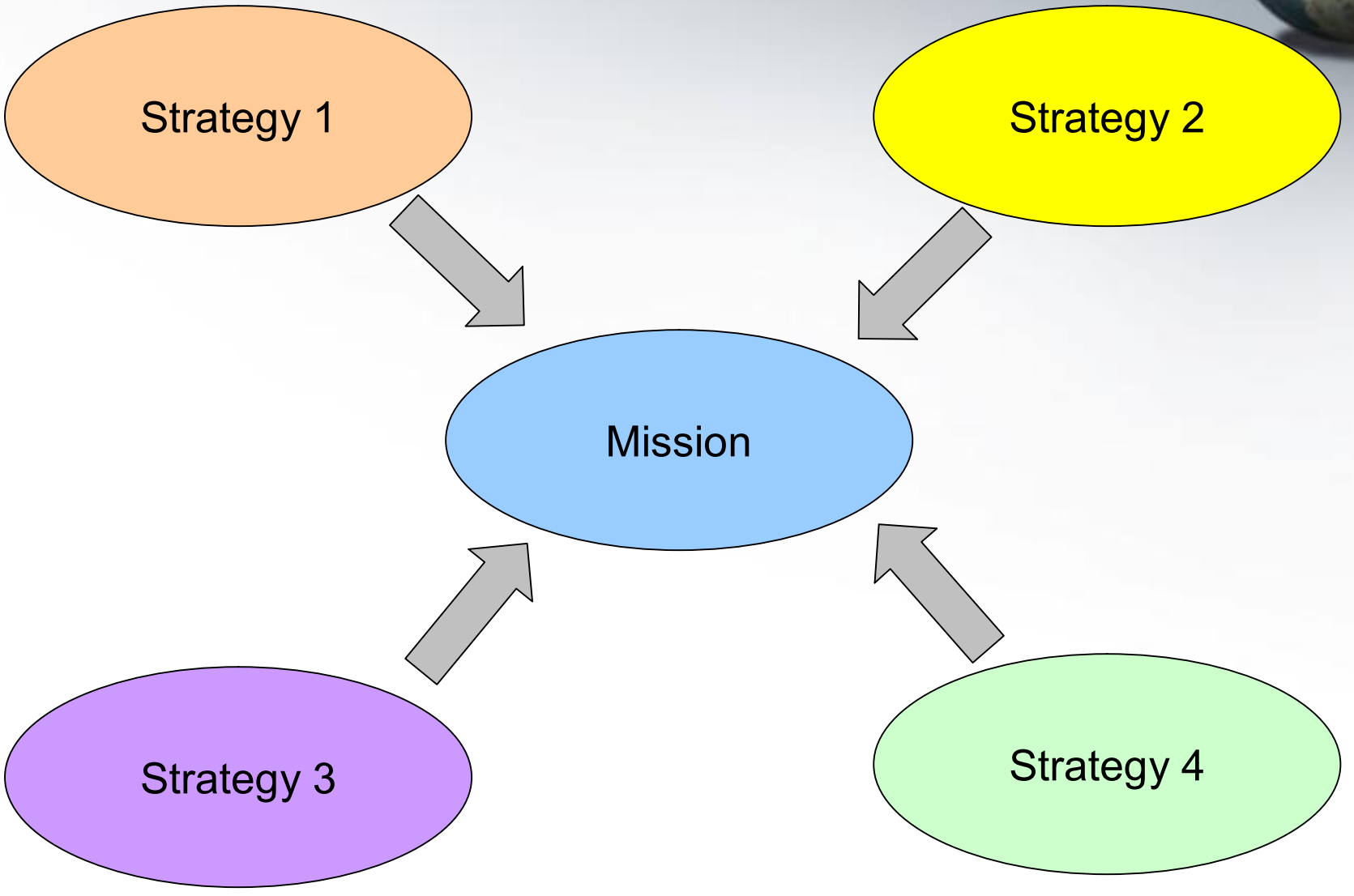
From the Vision Document

- NASA will
  - –invigorate its workforce,
  - –focus its facilities, and
  - –revitalize its field centers.

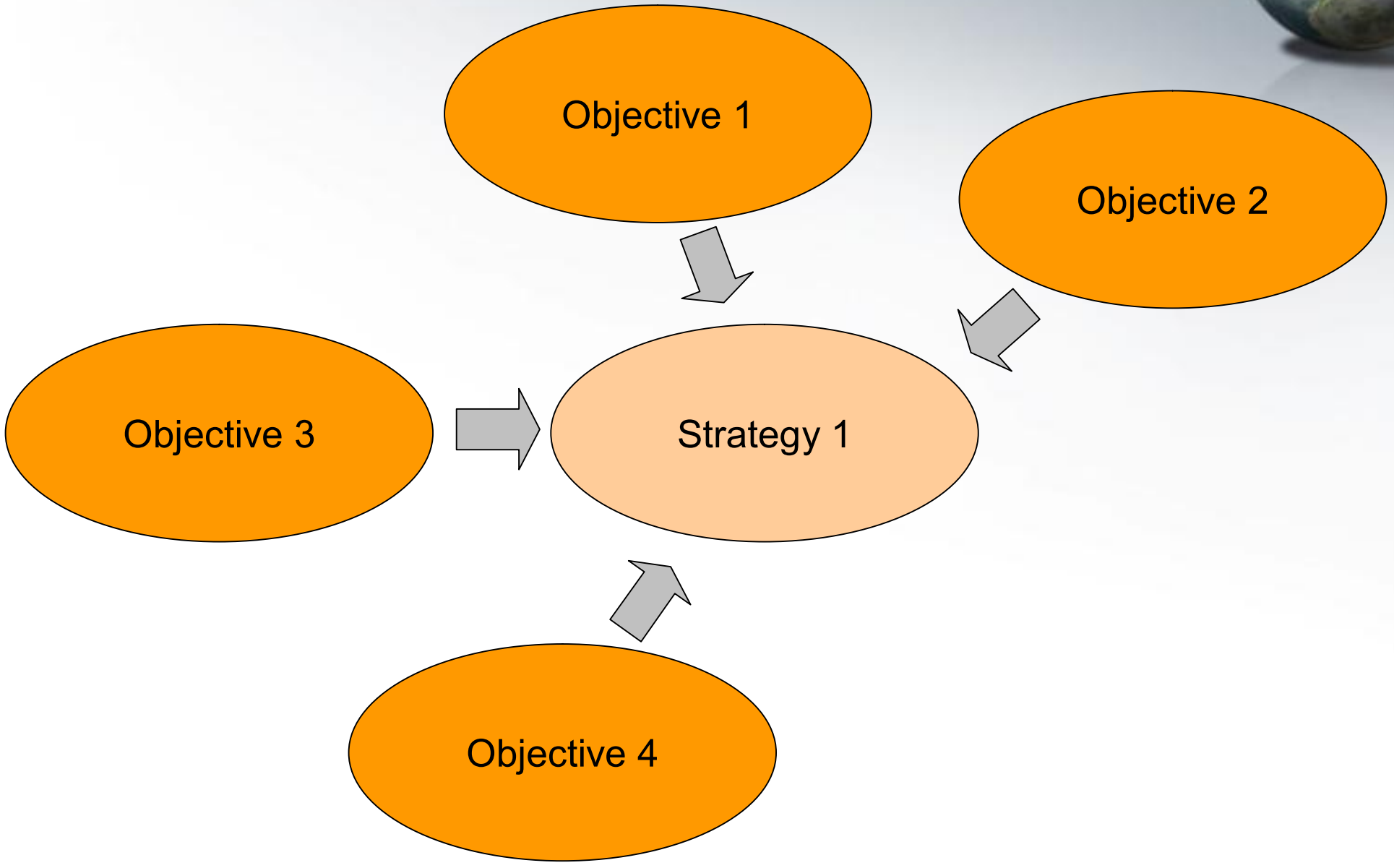
Building Lasting Solutions

1. Identify mission strategies & objectives
2. Map strategic priorities for mission accomplishment
3. Develop sustainability objectives
4. Map sustainability objectives to strategic roadmap
5. Review & revise per stakeholder feedback
6. Develop metrics & indicators
7. Execute sustainability plan
8. Measure progress
9. Seek out new opportunities
10. Adjust & repeat

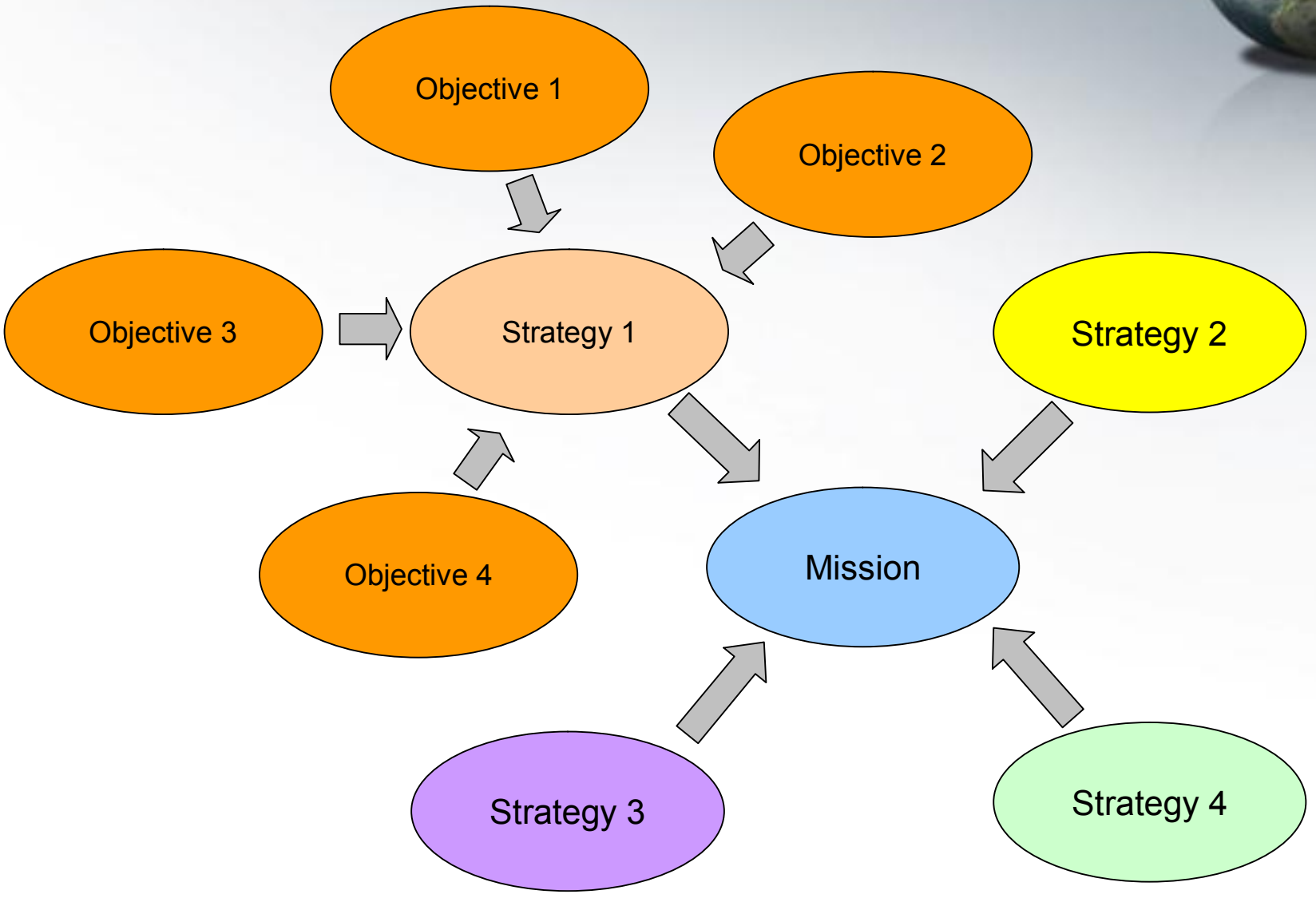
Map Core Strategies



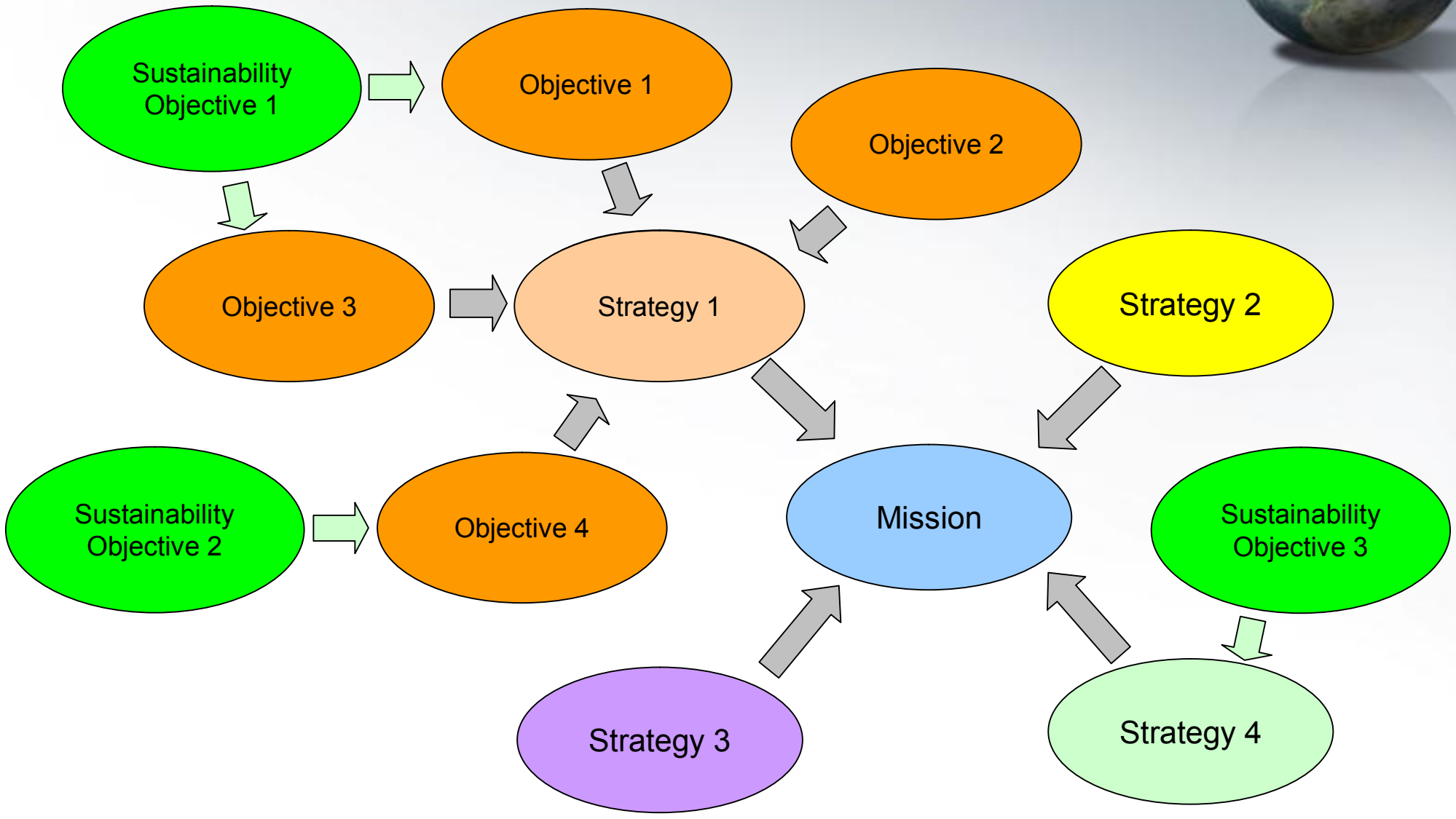
Objectives Serve Strategies



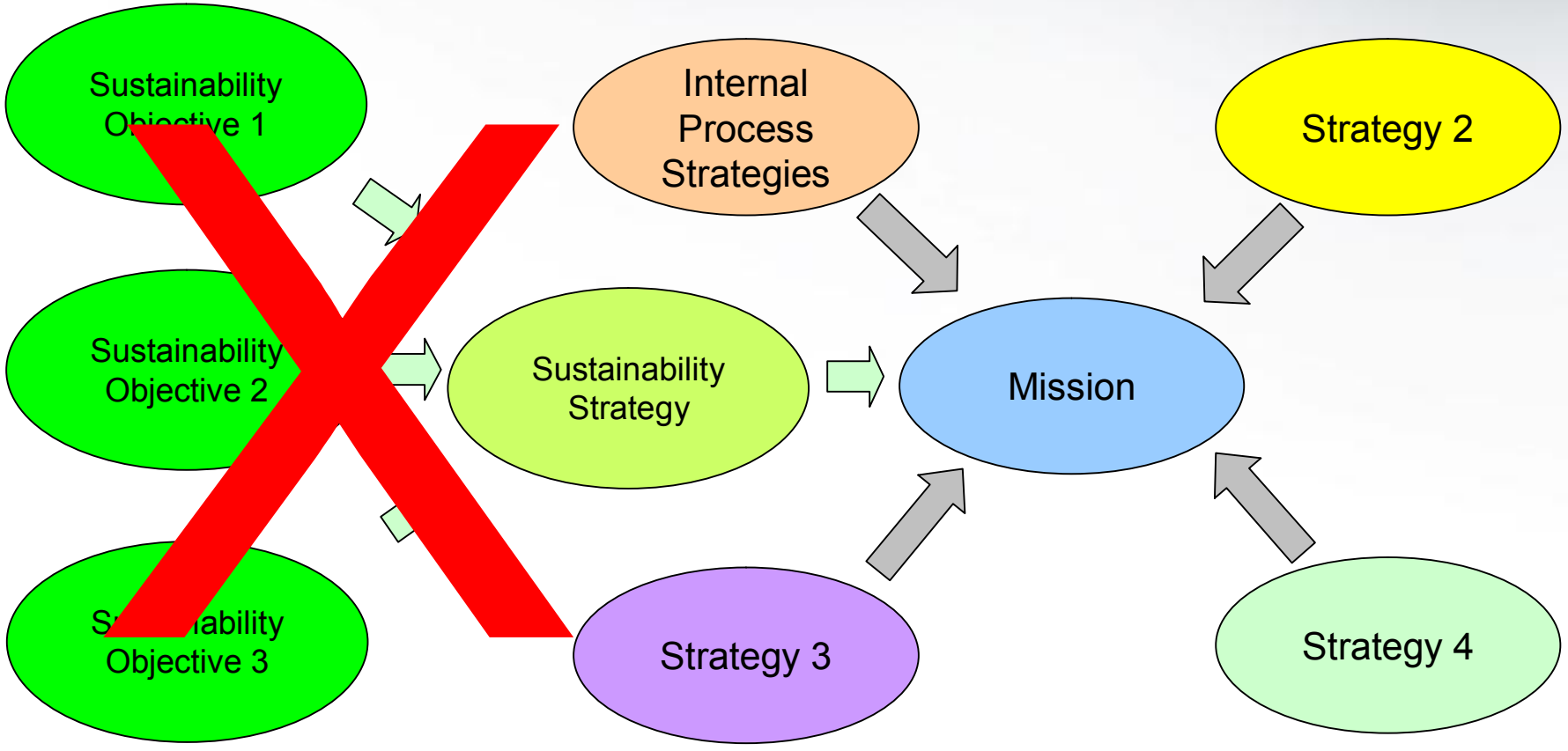
Map the Objectives



Integrated Sustainability



NOT "Add-On" Sustainability



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Stakeholder Engagement

- Prioritization reviews with operating departments
- External stakeholder advisory bodies
- Public workshops
- Charrettes
- Joint planning exercises & activities

Metrics & Indicators

Example: LCA

- All capital investments
- All non-capital above $XXX,XXX
- Life cycle data for all consumables above $XXX,XXX/year
- XX% reduction in life cycle costs
- $XXX,XXX in NPV value of savings

Building Lasting Solutions

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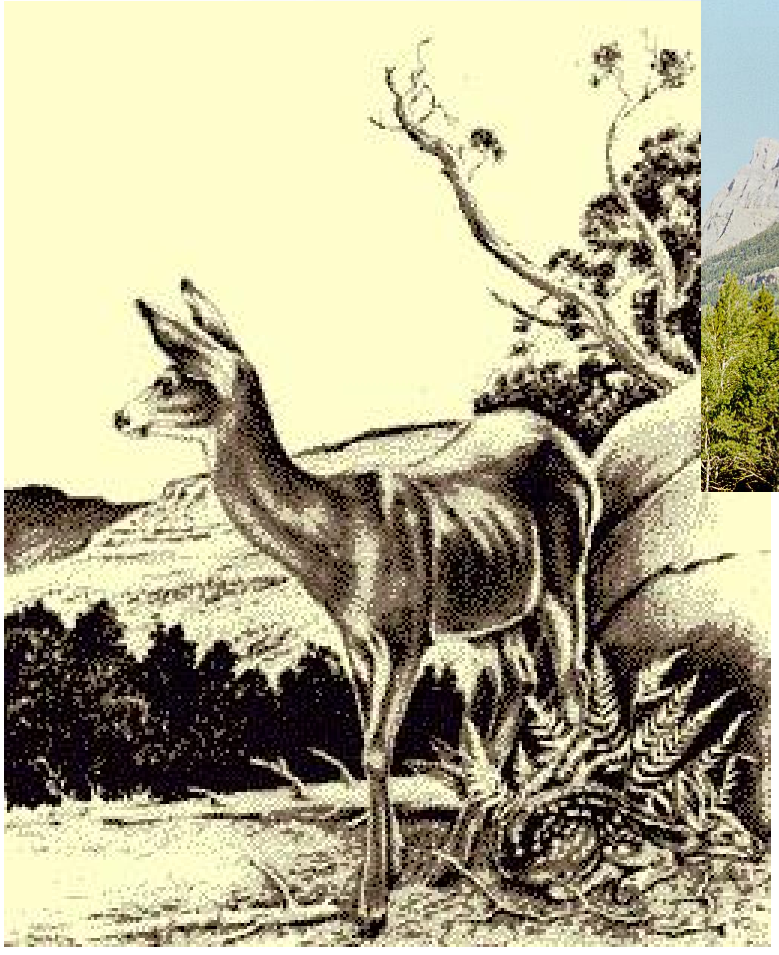
Three Disciplines for “Getting it Done”

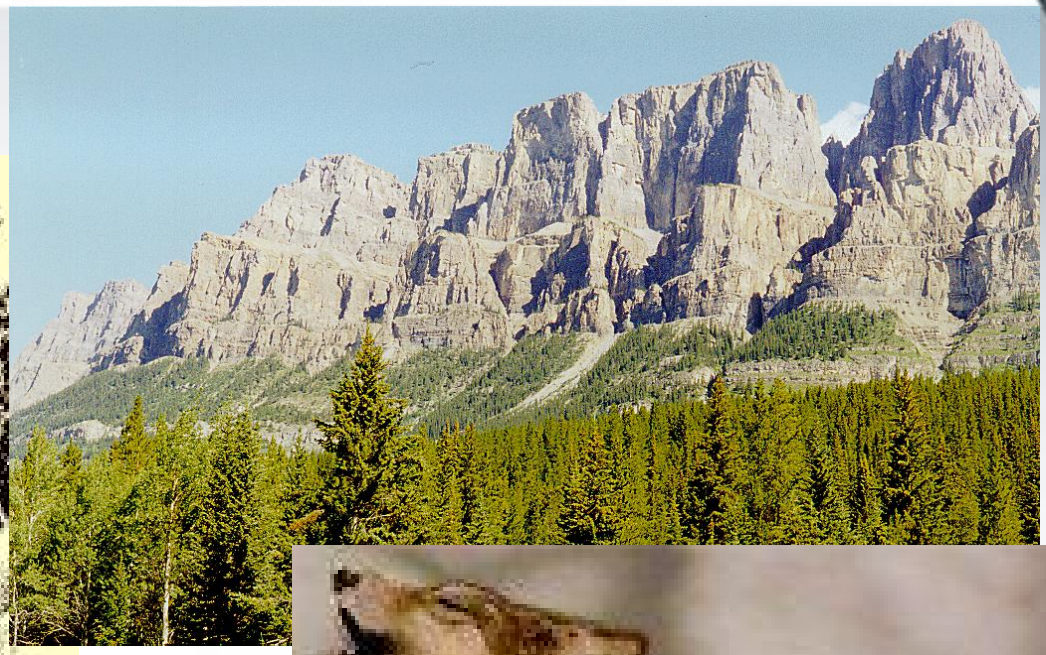
Three Disciplines

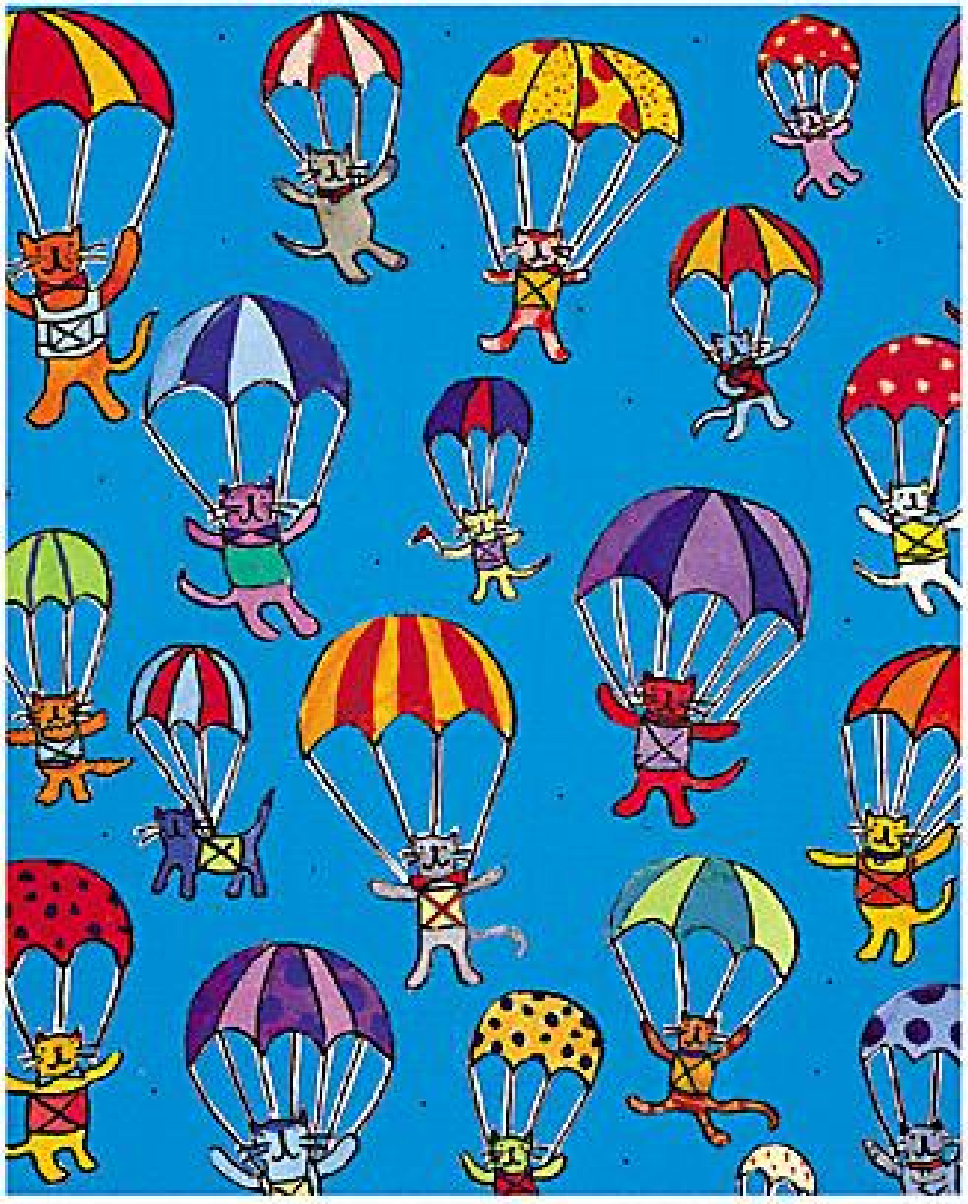
- Systems Thinking
- Solving for Multiple Criteria
- Managing Technological Change

Three Disciplines for “Getting it Done”

Systems Thinking



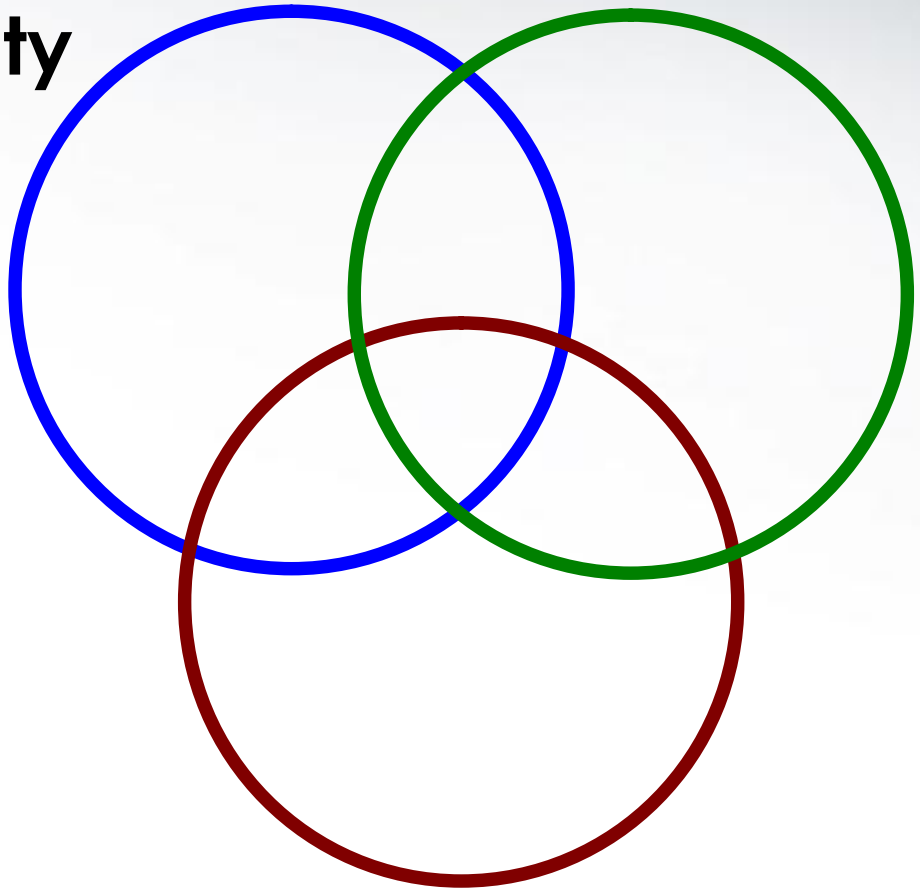




Three Disciplines for “Getting it Done”

Solving for Multiple Criteria

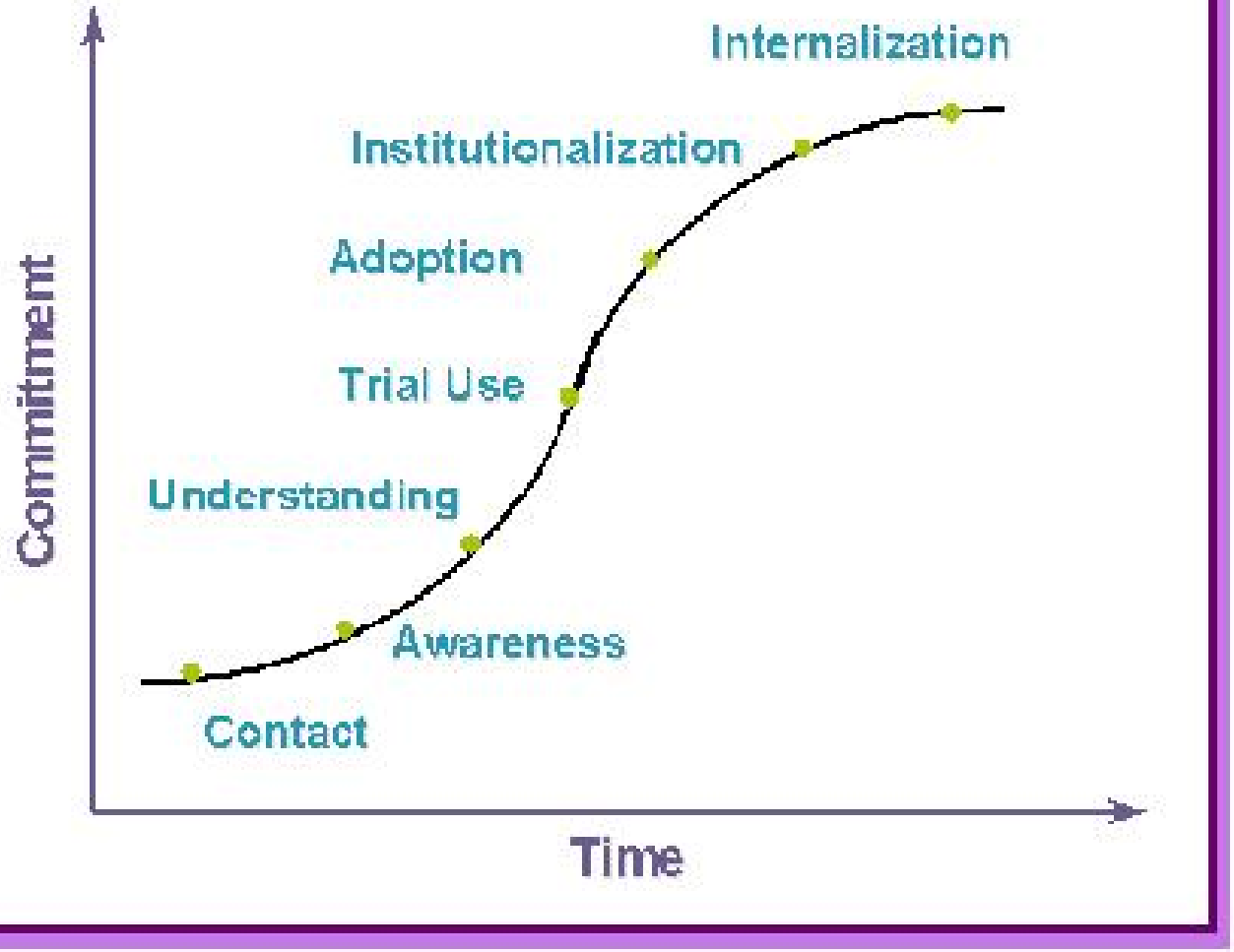
Sustainable Development

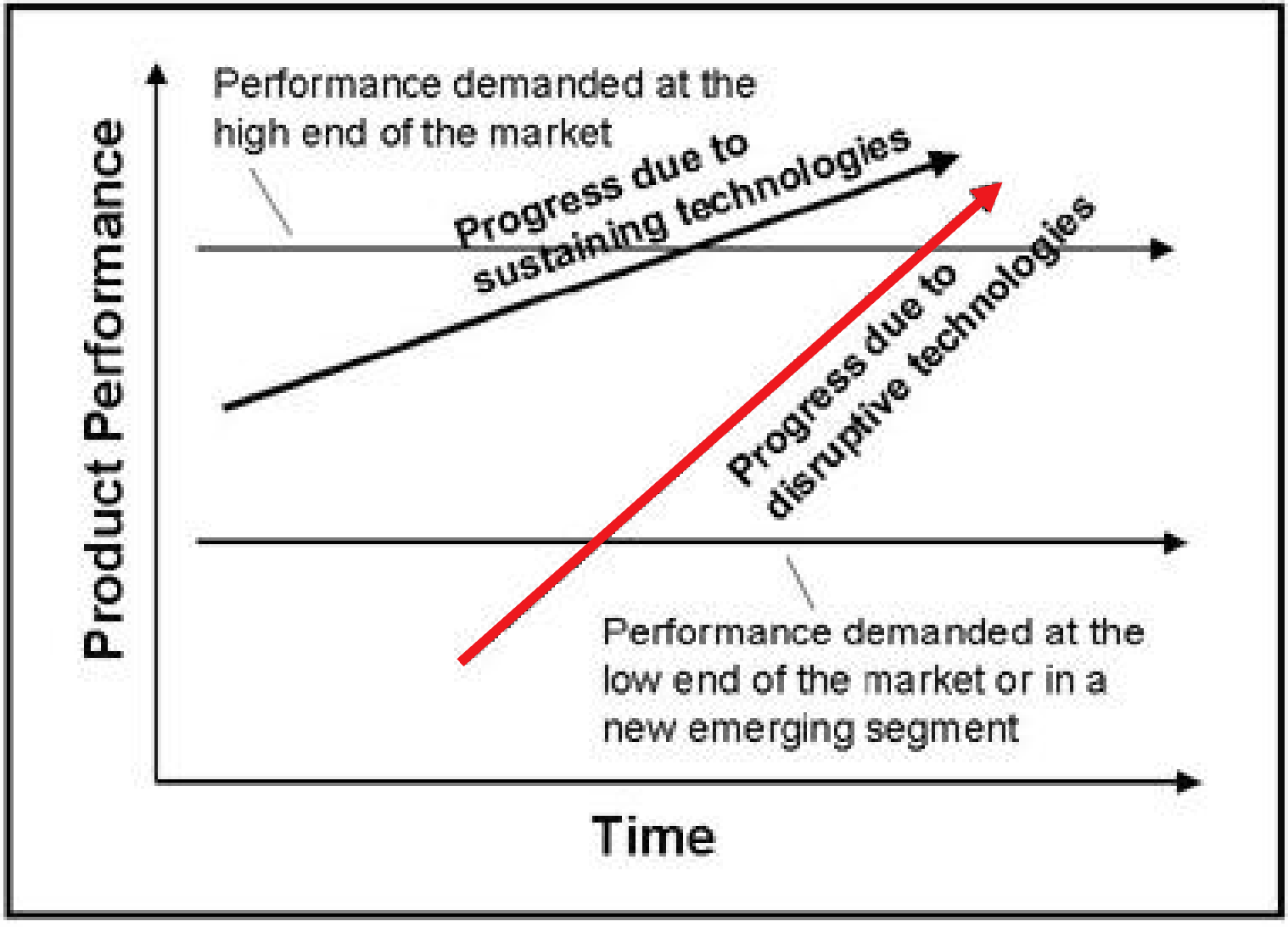


Three Disciplines for “Getting it Done”

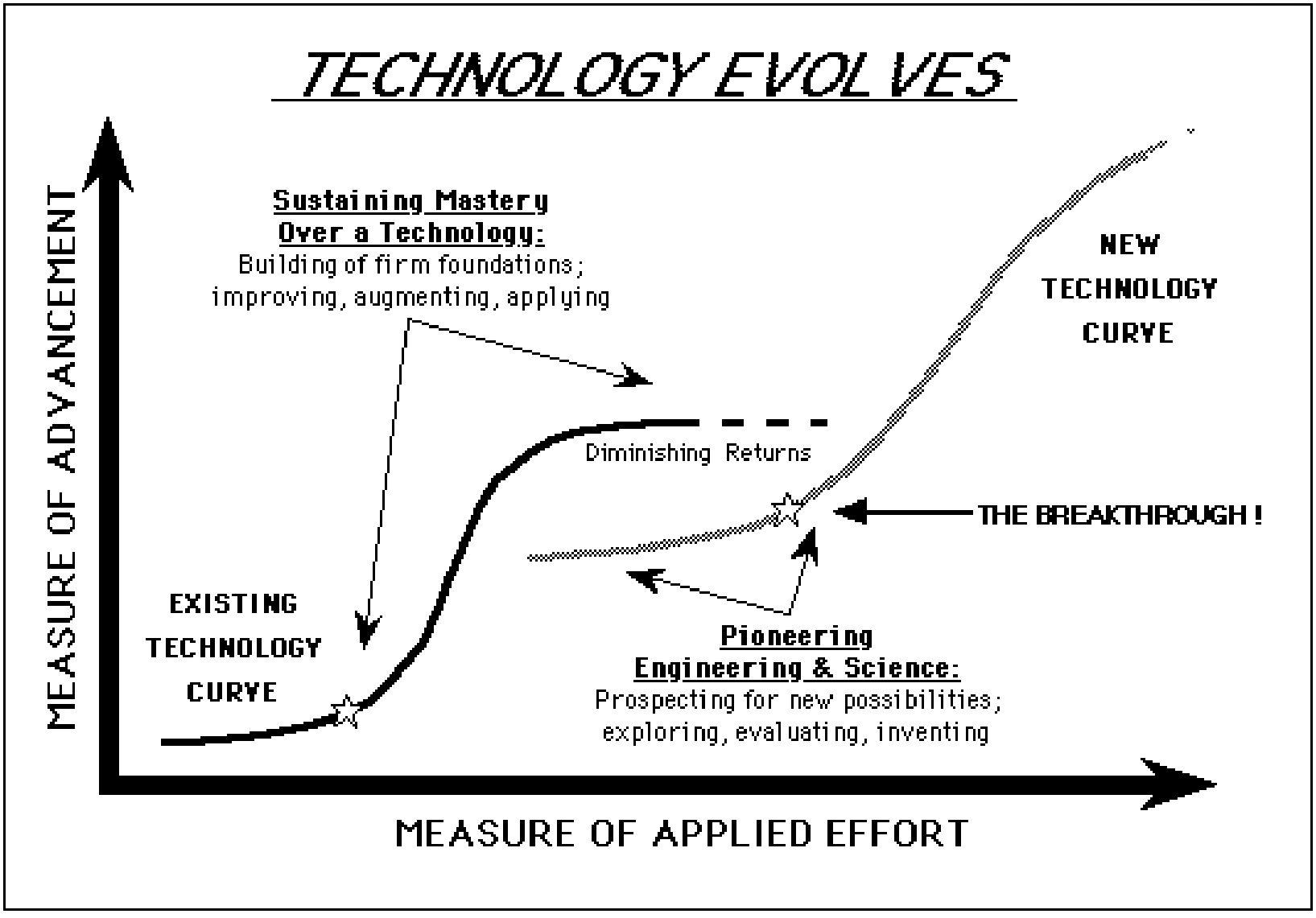
Managing Technological Change

Figure 2. *The standard technology adoption S-curve.*




Product Performance
Performance demanded at the high end of the market
Progress due to sustaining technologies
Progress due to disruptive technologies
Performance demanded at the low end of the market or in a new emerging segment
Time


ERIE SHOVEL
TYPE B ERIE SHOVEL Built By BALL ENGINE CO.


TECHNOLOGY EVOLVES
MEASURE OF ADVANCEMENT
Sustaining Mastery
Over a Technology:
Building of firm foundations;
improving, augmenting, applying
NEW
TECHNOLOGY
CURVE
Diminishing Returns
THE BREAKTHROUGH !
EXISTING
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Pioneering
Engineering & Science:
Prospecting for new possibilities;
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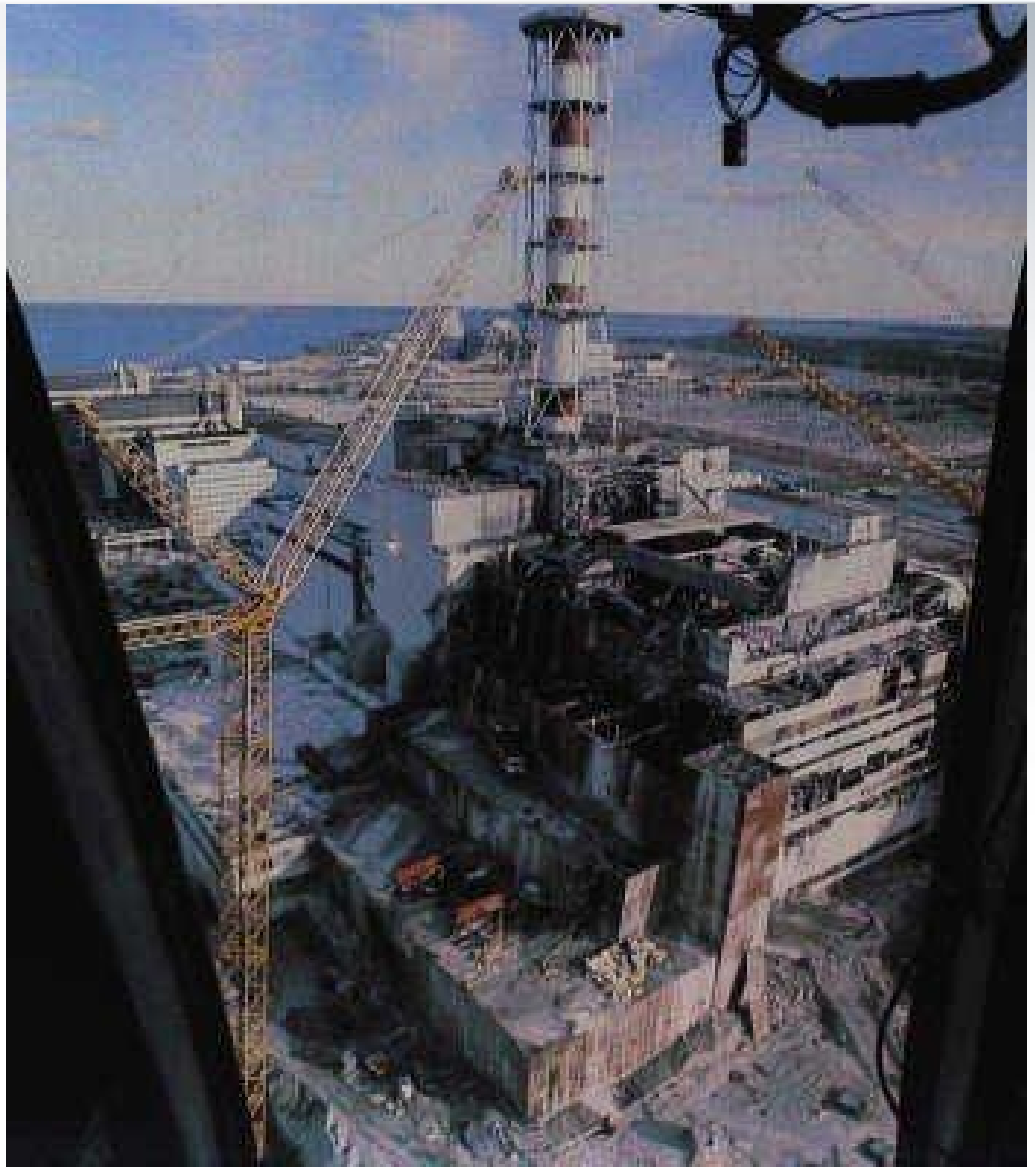
MEASURE OF APPLIED EFFORT



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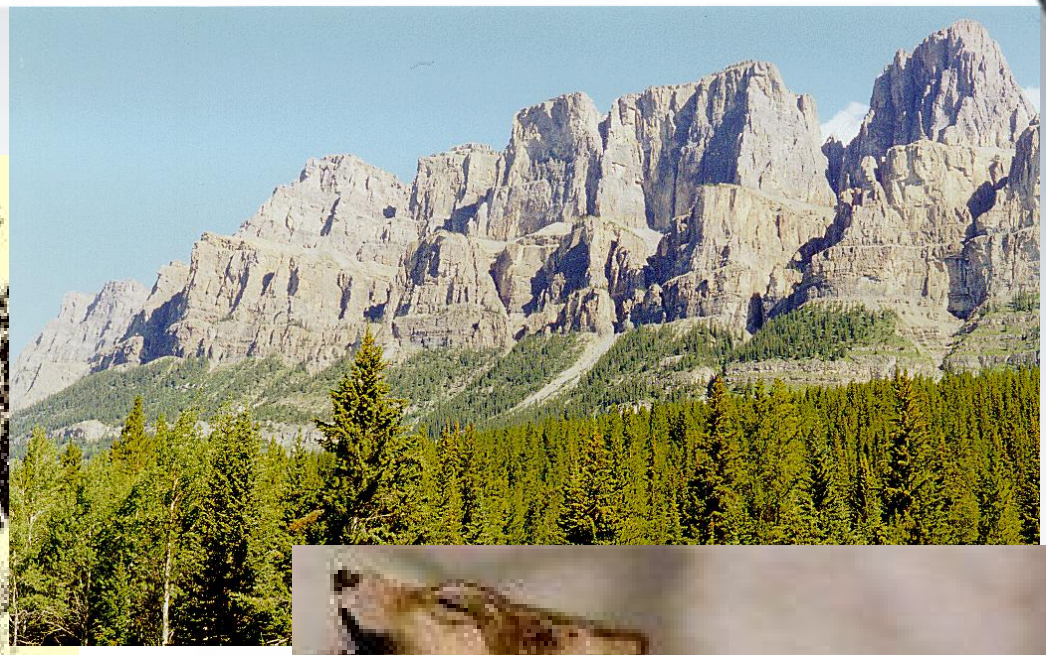
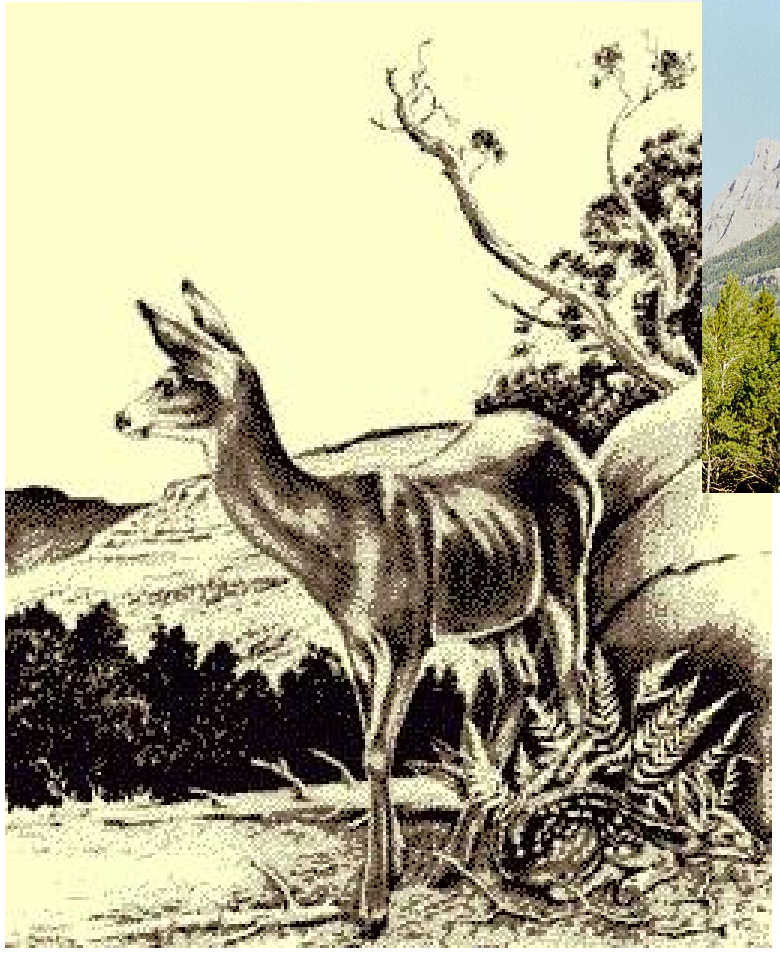
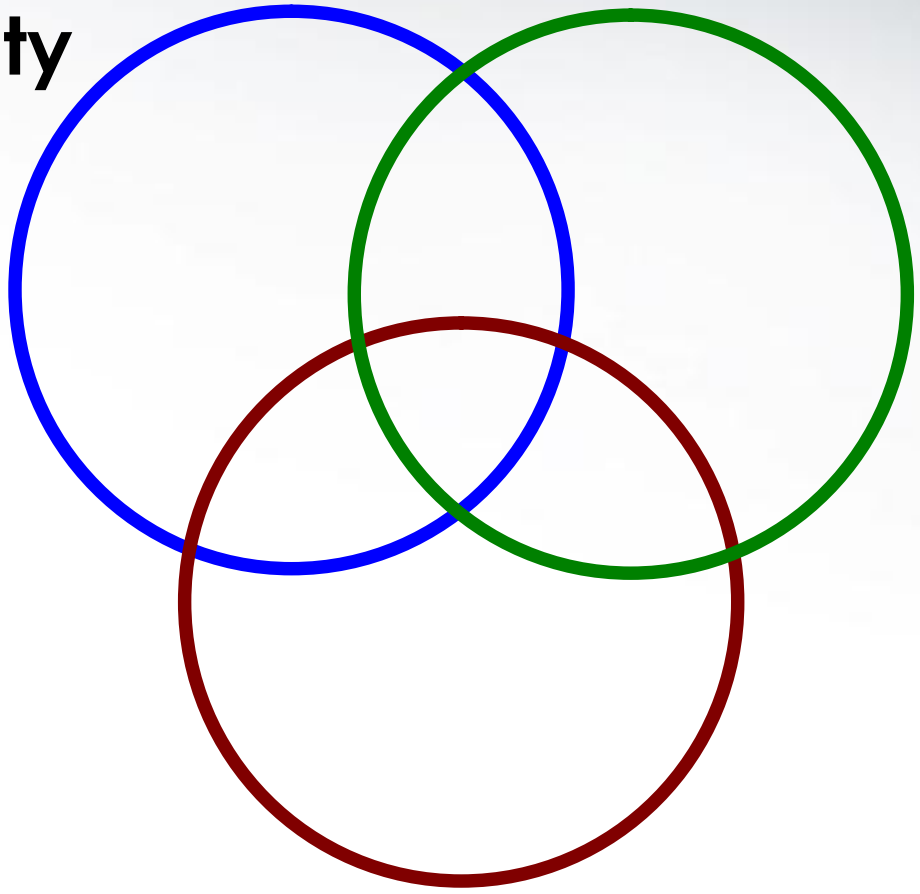
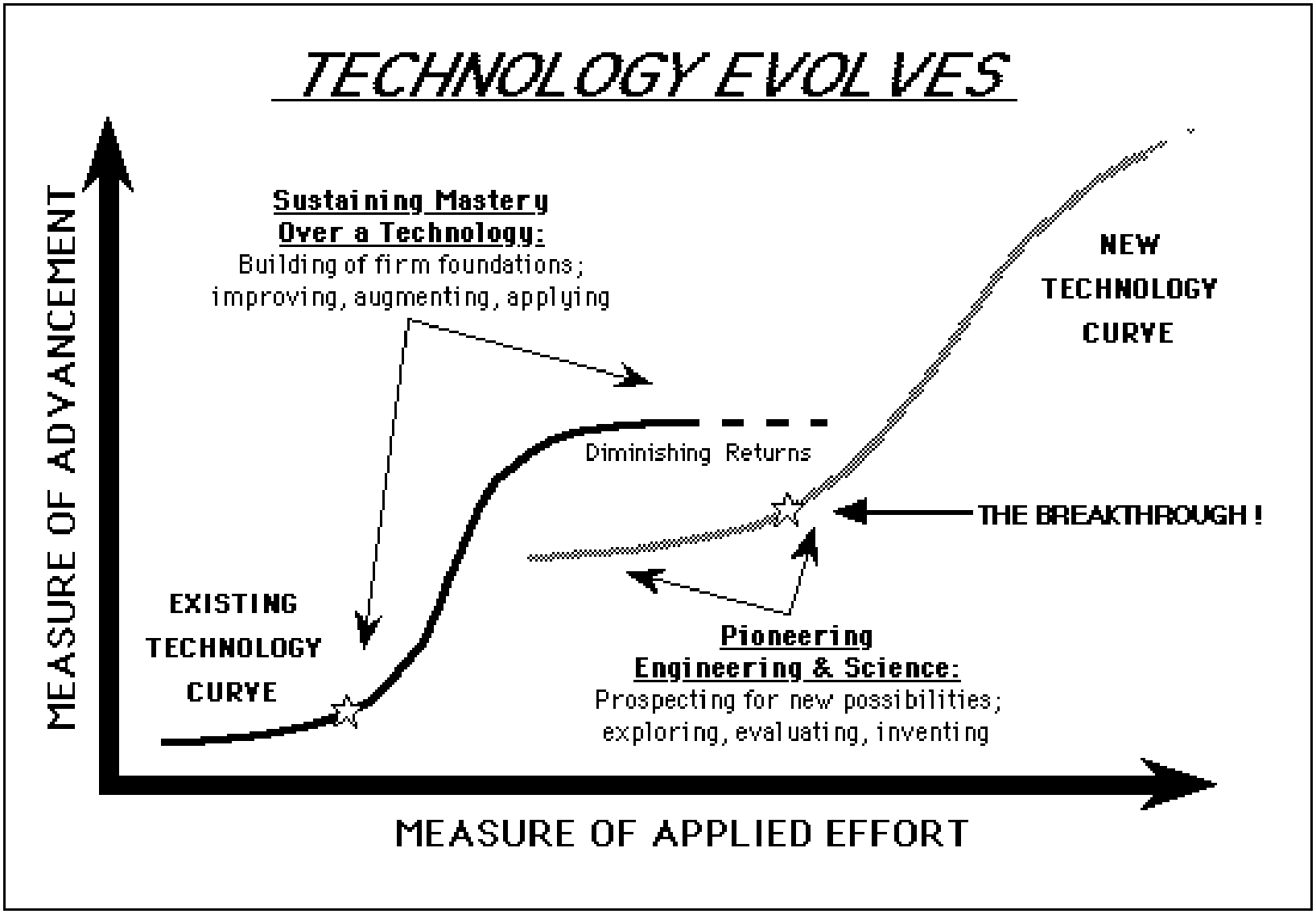




Sustainable Development

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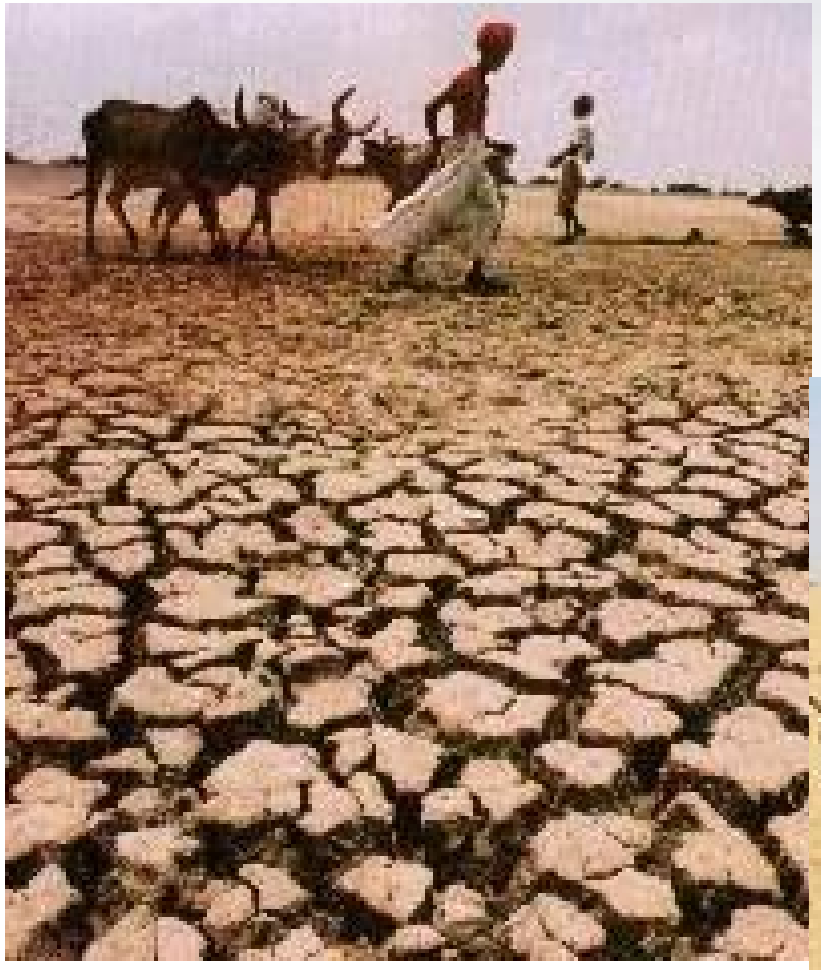
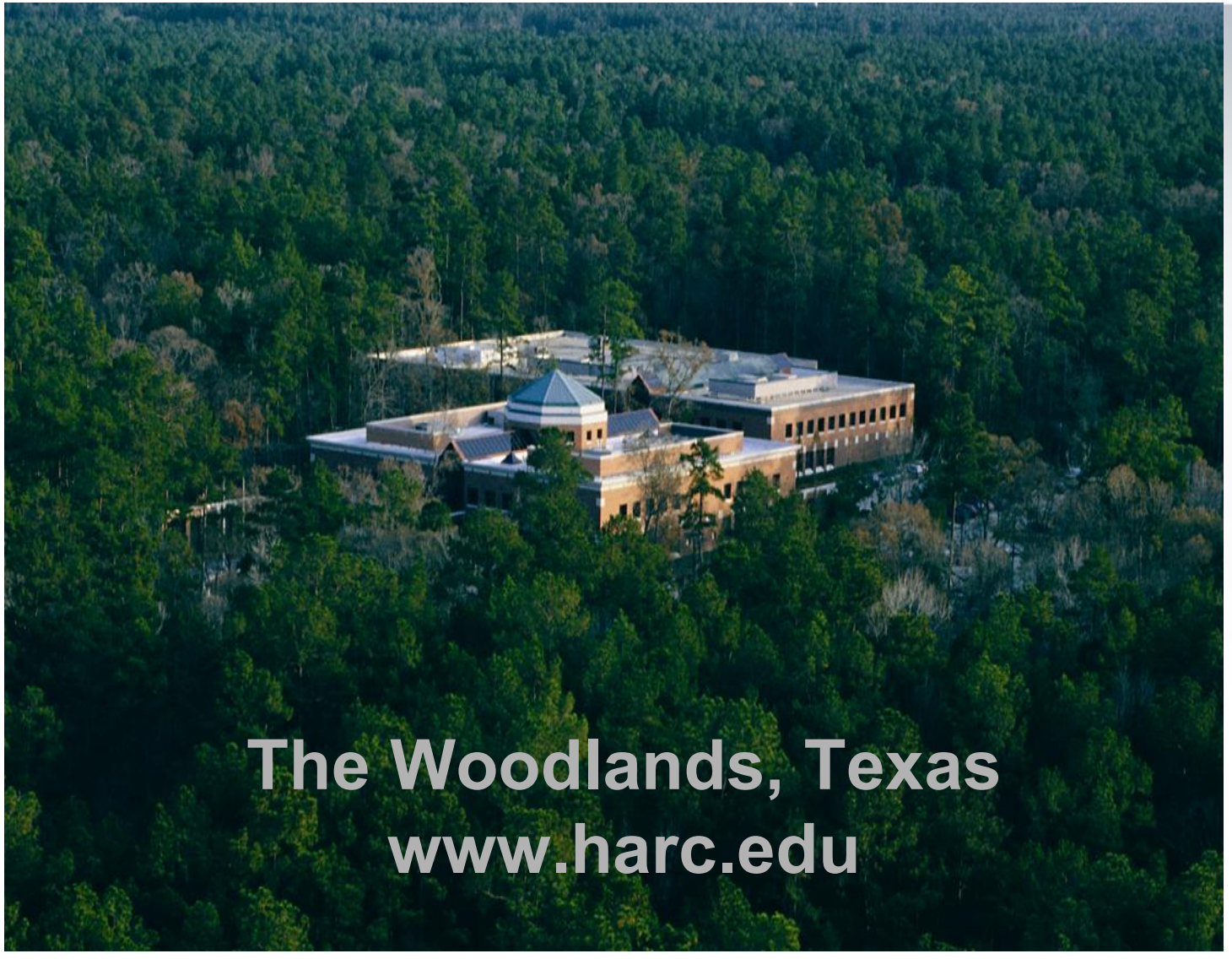
MEASURE OF APPLIED EFFORT

Concluding Thoughts




(AP PHOTO)

Houston Advanced Research Center



Thanks!